

# **National Security and Emergency Preparedness Communications Experiments Using the Advanced Communications Technology Satellite**

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## **FOREWORD**

This report describes experimentation with an advanced telecommunications satellite—the Advanced Communications Technology Satellite (ACTS) launched and operated by the National Aeronautics and Space Administration (NASA). The experimentation included measurement and analysis of the performance of several applications as well as investigation of protocol performance over the satellite channel. The opportunity to perform the work described herein is the result of the collaboration of several organizations—Government agencies and corporations—and the support provided by a sponsor.

The ACTS Collaboration, as it has been called, developed when several ACTS Experimenters determined that they had similar goals and interests. By combining resources, a small network of ACTS Earth stations (three of them) including several kinds of terrestrial connections was assembled. Using this experimental network and complementary skills, the ACTS Collaboration was able to perform several applications performance experiments and one experiment on the performance of an Internet protocol over the satellite.

Although each collaborator was able to provide some support, the National Communications System (NCS) Office of Programs sponsored much of the experimentation. This sponsor also is an ACTS Experimenter. The NCS mission to provide communications in support of National Security and Emergency Preparedness (NS/EP) gave the ACTS Collaboration a central purpose.

The National Telecommunications and Information Administration, Institute for Telecommunication Sciences (NTIA/ITS) provided liaison with NASA and the sponsor and performed the application experiment on voice quality. The National Institute for Standards and Technology, Computer Systems Laboratory (NIST/CSL) performed an application experiment on desktop conferencing and another application experiment on local areal network (LAN) bridging. COMSAT Laboratories assisted NIST with satellite access and performed an experiment using Internet communications protocols. MITRE Corporation contributed to the design of experiments useful for NS/EP and assisted all of the collaborators with the experiments.

Collaborator points-of-contact are: Dr. William A. Kissick, coordinator and principal investigator, NTIA/ITS; Mr. Wayne McCoy and Ms. Mary Ruhl, NIST/CSL; Dr. Prakash Chitre, COMSAT; and Mr. Michael Nissley, MITRE. The NCS is represented by Mr. Frank Dixon.

Section 1 of this report was prepared by NTIA/ITS with input from all of the collaborators, especially NIST/CSL. Section 2 was prepared by NTIA/ITS. Sections 3 and 4 were prepared by NIST/CSL. Section 5 was prepared by COMSAT.

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## ACRONYMS AND ABBREVIATIONS

ACTS	Advanced Communications Technology Satellite
ATM	asynchronous transfer mode
BER	bit error ratio
BRI	basic rate interface (ISDN 2B+D)
COTS	commercial off-the-shelf (equipment)
CRC	cyclical redundancy check
DCT	discrete cosine transform
DSP	digital signal processor
$E_b/N_0$	energy per bit to noise energy ratio
ES	Earth station
ERS	Emergency Response Site
FFT	fast Fourier transform
FRACS	frame relay access switch
FTP	File Transfer Protocol
FTS2000	ISDN service in the Federal Government
GETS	Government Emergency Telephone Service
GUI	graphical user interface
H.320	ITU-T Recommendation on videoconferencing
HO	home office
ISDN	integrated services digital network
IP	Internet protocol
ITS	Institute for Telecommunication Sciences
LAN	local area network
LEO	low earth orbit
MOS	mean opinion score
NCS	National Communications System
NII	National Information Infrastructure
NIST	National Institute of Standards and Technology
NLP	National Level Program
NS/EP	National Security and Emergency Preparedness
NTIA	National Telecommunications and Information Administration
OS	opinion score
PBX	private branch exchange
PC	processing center
POTS	plain old telephone service
PRI	primary rate interface (ISDN 24B+D)
PSN	public switched network
QOS	quality of service
RTT	round-trip time
T1	digital transmission service at 1.544 Mb/s
TCP	transmission control protocol

## **ACRONYMS AND ABBREVIATIONS (cont.)**

TCP/IP	transmission control protocol/Internet protocol
TCP-LFN	transmission control protocol – long fat network
VQAS	voice quality assessment system
VSAT	very small aperture terminal
WAN	wide area network